Summary of last lecture

- Keys – super key, candidate key, primary key and foreign key
- E-R diagram - example
  a. department
  b. college
  c. online shopping

Extended E-R Diagram(EER)

- An enhanced entity-relationship model, also known as an extended **entity-relationship model**, is a type of database diagram that's similar to regular ERDs.
- Enhanced ERDs are high-level conceptual models that accurately represent the requirements of complex databases.
- In addition to E-R diagram, EERDs include:

- Subtypes and supertypes (sometimes known as subclasses and superclasses)
- Attribute and relationship inheritance
- Specialization or generalization
- Aggregation

Extended E-R Diagram (EER) Cont.…

- **Subclasses and Super-classes**

➢ An entity type may have additional meaningful sub-groupings of its entities

➢ **Example:** EMPLOYEE may be further grouped into SECRETARY, ENGINEER, MANAGER, TECHNICIAN, SALARIED_EMPLOYEE, HOURLY_EMPLOYEE,…

✓ Each of these groupings is a subset of EMPLOYEE entities

✓ Each is called a subclass of EMPLOYEE

✓ EMPLOYEE is the superclass for each of these subclasses

➢ These are called super-class/subclass relationships.

Extended E-R Diagram (EER) Cont.…

- **Example:**

  EMPLOYEE/SECRETARY,

  EMPLOYEE/TECHNICIAN

- These are also called IS-A relationships

  (SECRETARY IS-A EMPLOYEE, TECHNICIAN IS-A EMPLOYEE, …).

Extended E-R Diagram (EER) Cont.…

- **Specialization**

- Top-down design process; we designate subgrouping within an entity set that are distinctive from other entities in the set.

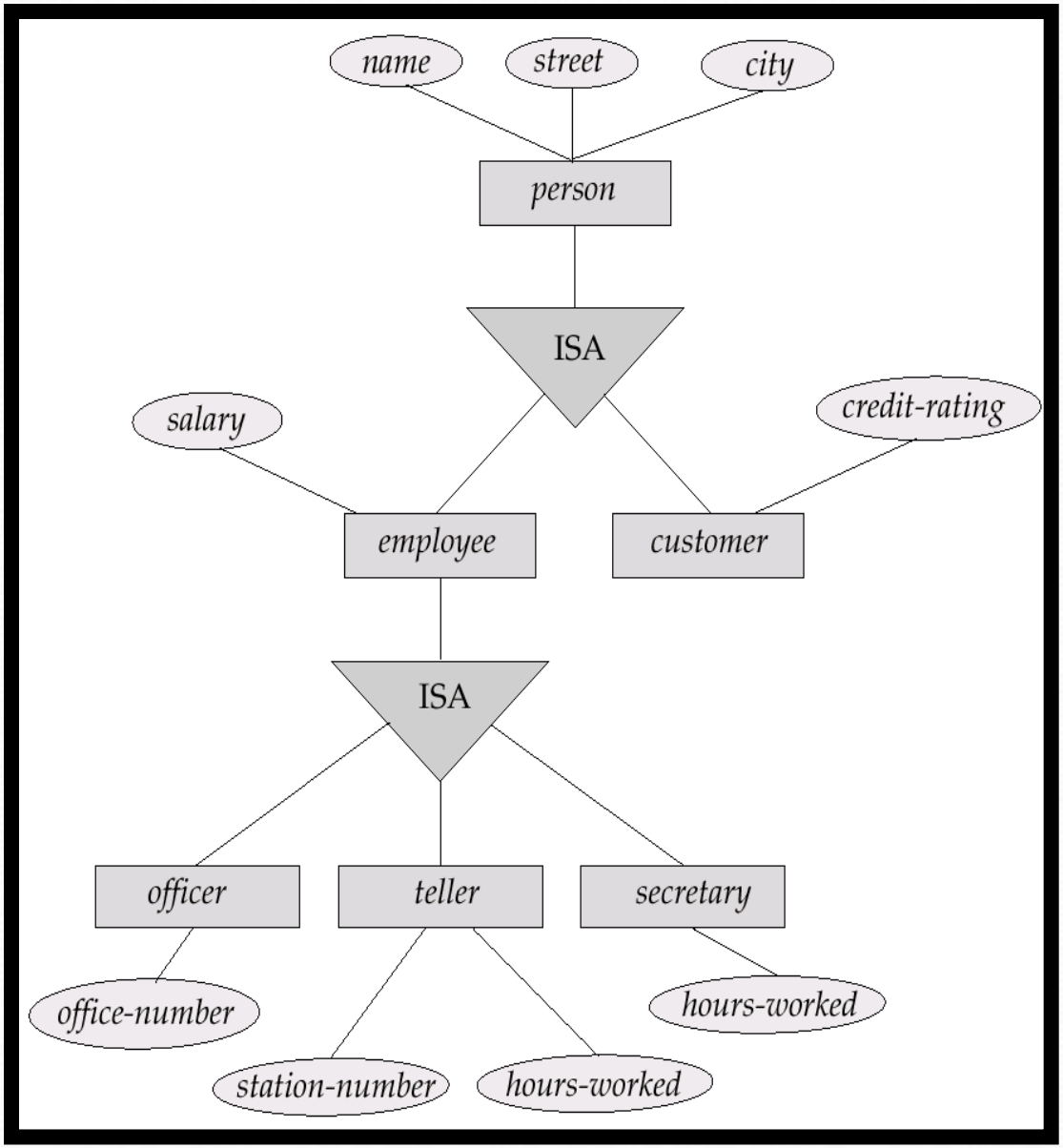
- These subgrouping become lower-level entity sets that have attributes or participate in relationships that do not apply to the higher-level entity set.

- Depicted by a *triangle* component labeled ISA (E.g. *customer* "is a" *person*).

- **Attribute inheritance** – a lower-level entity set inherits all the attributes and relationship participation of the higher-level entity set to which it is linked.

Extended E-R Diagram (EER) Cont....

- **Specialization Example**



Extended E-R Diagram (EER) Cont.…

- **Generalization**

- A bottom-up design process – combine a number of entity sets that share the same features into a higher-level entity set.

- **Specialization and generalization** are simple inversions of each other; they are represented in an E-R diagram in the same way.

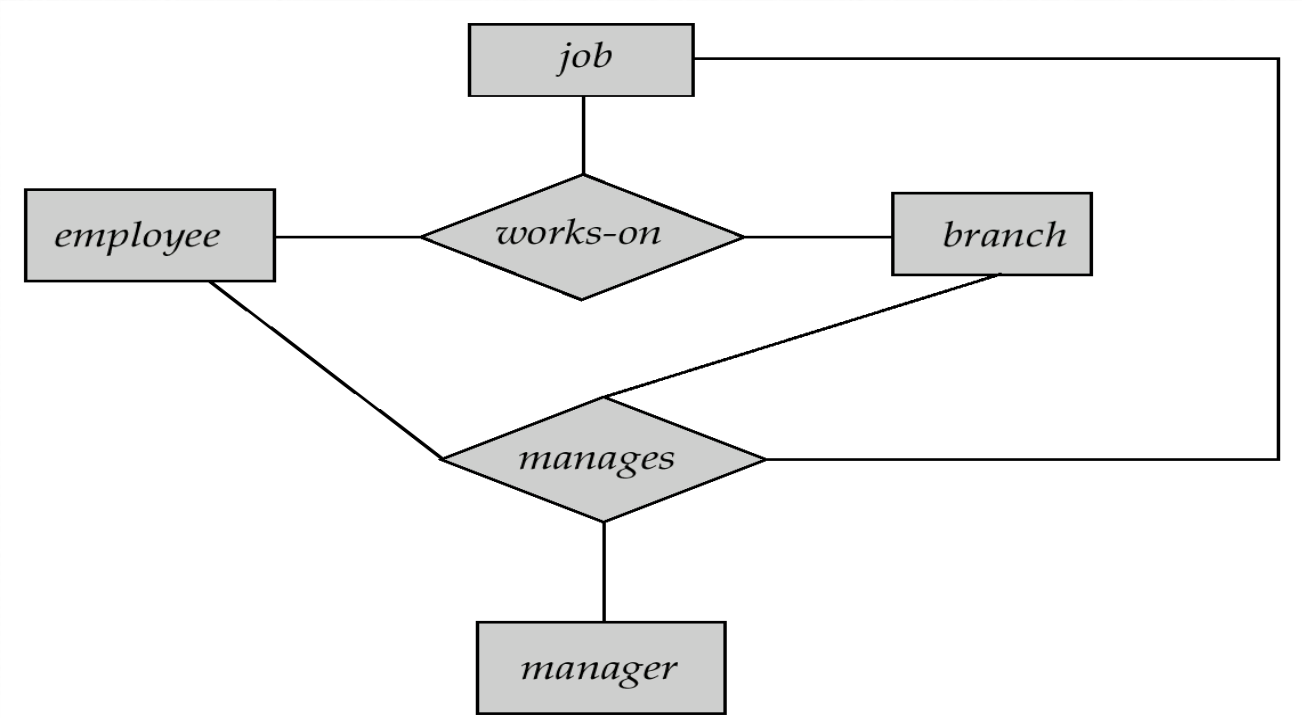
- The terms specialization and generalization are used interchangeably.

Extended E-R Diagram (EER) Cont.…

- **Aggregation**

- One limitation of the E-R model is that it cannot express relationships among relationships.

- Consider the ternary relationship *works-on:*

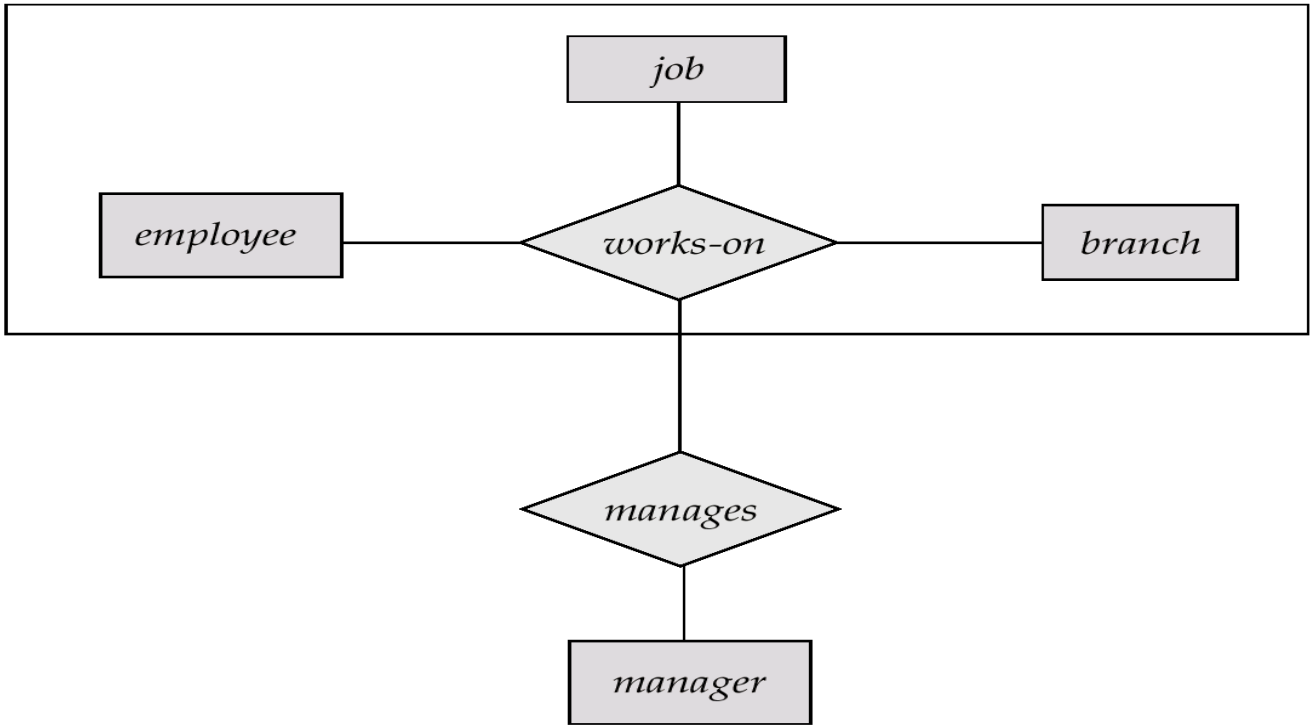


Extended E-R Diagram (EER) Cont….

- **Aggregation-** Aggregation is an abstraction through which relationships are treated as higher-level entities.

➢ Without introducing redundancy, the following diagram represents:

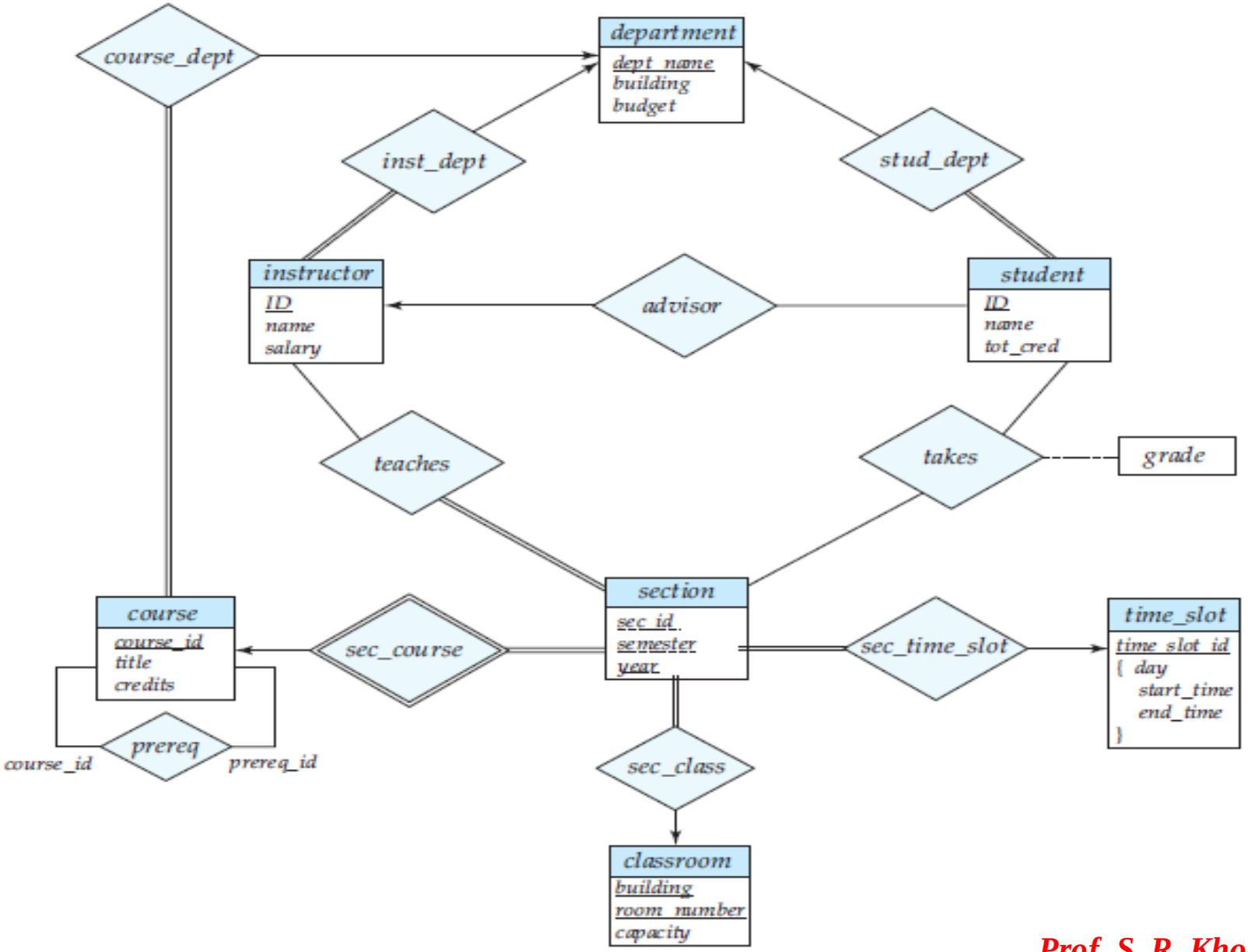
- ✓ An employee works on a particular job at a particular branch
- ✓ An employee, branch, job combination may have an associated manager



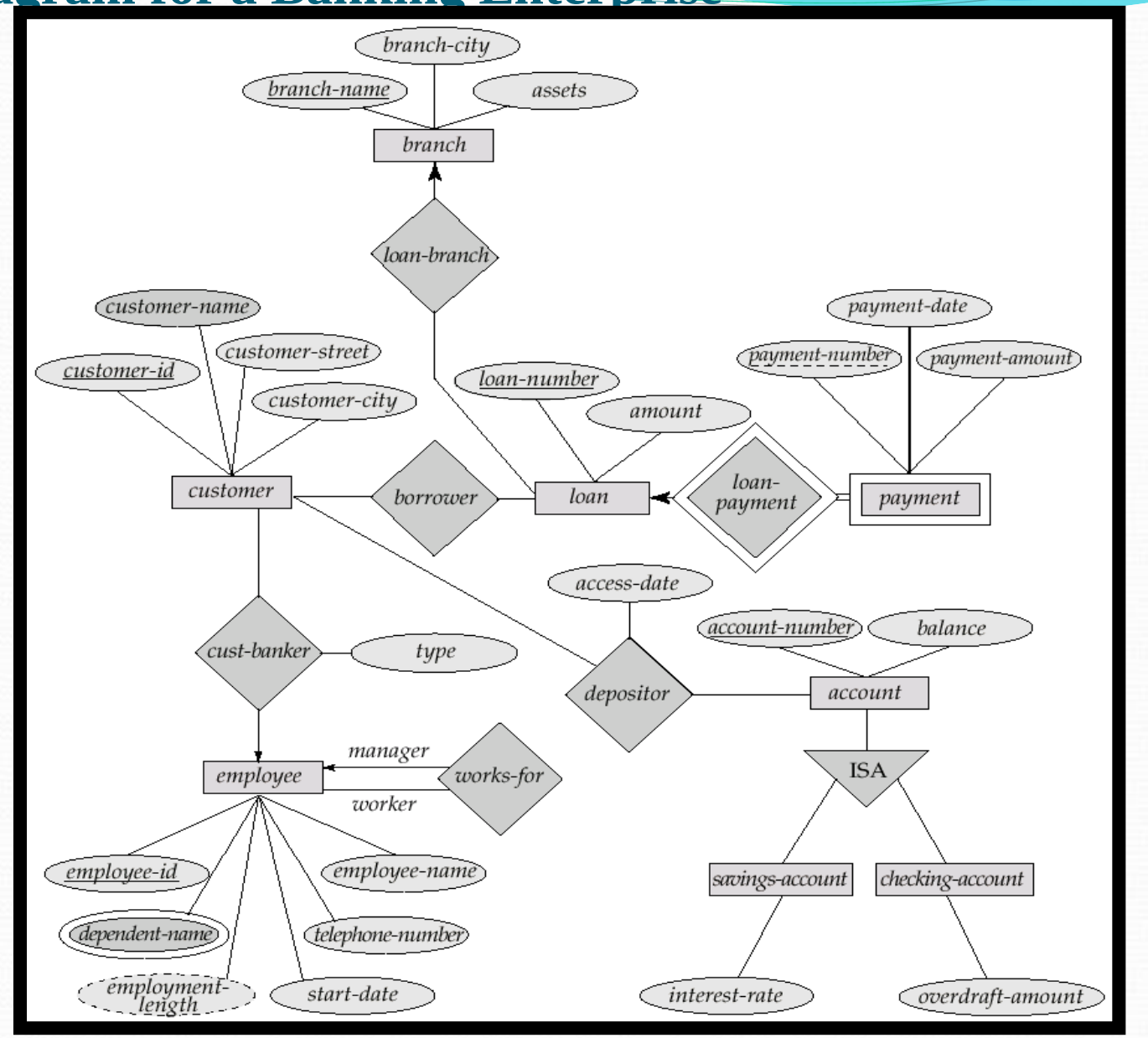
E-R Diagram for a University Database

classroom(building, room number, capacity)
department(dept name, building, budget)
course(course id, title, dept name, credits)
instructor(ID, name, dept name, salary)
section(course id, sec id, semester, year, building, room number, time slot id)
teaches(ID, course id, sec id, semester, year)
student(ID, name, dept name, tot cred)
takes(ID, course id, sec id, semester, year, grade)
advisor(s ID, i ID)
time slot(time slot id, day, start time, end time)
prereq(course id, prereq id)

E-R Diagram for a University Database



E-R Diagram for a Banking Enterprise



Converting ER diagram into tables

- Strong Entity Set – Individual table for each entity set with all attributes.

- Attributes -
  - Simple/Single valued – column in table
  - Composite – represented as individual columns in table
  - Multi-valued – separate table for attribute with two fields (*Primary key of table and Multivalued attribute)*

- Weak Entity Set – Separate table for weak entity with all attributes along with primary key of identifying entity.

Converting EER diagram into tables

- Relationship set – Separate table consist of primary key of all entities participating in relation.

- Specialization/Generalization – Separate table for higher level and lower level entity set.

eg. person(ID,name,street,city)

employee(ID,salary)

student(ID, marks)

- Aggregation – Consist of all primary keys for aggregate relationship and entity.

END

OF

UNIT I